COURSE SYLLABUS

Syllabus for: MECH 1100 Electrical Components

Former Course(s): none

Catalog Description: This course is a study of the basic electrical components in a mechatronic system. Topics covered will include basic functions and physical properties of electrical components; the systematic flow of energy and measurement of components; troubleshooting techniques and strategies to identify, localize and correct malfunctions; and systematic preventive maintenance and electrical component safety. Technical documentation such as data sheets, schematics, timing diagrams and system specifications will also be covered.

Credit Hours: 4 Contact Hours: 5 Lab Hours: 2

Prerequisite(s): None


Required Supplies/Material(s): calculator

Recommended Supplementary Material(s): handouts as appropriate

Student Group for Whom Course is Required/Intended: This course is intended for students pursuing the following degrees and programs of study.

Certificate: Mechatronics
Associate of Applied Science; Mechatronics Technology

Student Learning Outcomes: Upon completion of this course, students will demonstrate the ability to:

1. Show knowledge of the historical development of what comprises a mechatronic system or module.

2. Understand and apply electric safety rules while working on a mechatronic system.

3. Develop an understanding of the specific roles of various electrical components and power sources within a given system or module.

4. Analyze basic circuits using Ohm’s law, Kirchhoff’s laws and Watt’s law.
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Student Learning Outcomes (continued)

5. Analyze effectively series and parallel electrical circuits.

6. Know and explain physical operation of electromagnetic and electrostatic components such as coils, solenoids, relays, and various sensors used in a mechatronic system.

7. Understand and explain the basic physical properties of electrical components such as resistors, capacitors, diodes, transformers, relays, and power supplies.

8. Read, analyze and utilize the technical documents such as data sheets, timing diagrams, operation manuals, and schematics for a mechatronic system.

9. Take operative measurements on electrical components in a mechatronic system and understand how to interpret the results.

10. Effectively troubleshoot malfunctions in electrical components, based upon the technical documentation.

11. Understand how to trace and describe the flow of electrical energy in a mechatronic system.

Suggested Evaluation Plan:

<table>
<thead>
<tr>
<th>Task</th>
<th>Weight</th>
<th>Student Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid Term Exam</td>
<td>25%</td>
<td>1-8</td>
</tr>
<tr>
<td>Final Exam</td>
<td>25%</td>
<td>3-11</td>
</tr>
<tr>
<td>Quizzes (qty 4)</td>
<td>25%</td>
<td>1-11</td>
</tr>
<tr>
<td>Lab work</td>
<td>25%</td>
<td>1-11</td>
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</tbody>
</table>

Final Grading Plan: The grading scale for all examinations and the final course grade will be based on the following percentages:

- **A** = 90 - 100%
- **B** = 80 - 89%
- **C** = 70 - 79%
- **D** = 60 - 69%
- **F** = 0 - 59%
## Course Syllabus: MECH 1100

### Instructional Schedule:

<table>
<thead>
<tr>
<th>Week</th>
<th>Student learning outcomes</th>
<th>Content to be covered</th>
<th>Student Assignments/Supplementary Material</th>
</tr>
</thead>
</table>
| 1    | 1                         | History of mechatronics and the understanding of the system approach.  
Review complete mechatronics system, PLC controls, wiring, electrical elements, pneumatics, and mechanical elements | Chapter 1 , 2  
Handout on mechatronics and system philosophy  
Overview of mechatronics trainer. |
| 2    | 1,2,3,4                   | Basic electrical fundamentals and applications.  
Study ohms law  
Basic troubleshooting strategy  
Circuit diagrams  
Electrical safety  
Quiz 1 | Chapter 2 and 3  
Section checkup questions  
Study Circuit diagrams  
Overall electronics application in mechatronic system  
Lockout/tag out application |
| 3    | 4,5                       | Electrical fundamentals and applications. Series and parallel circuit study.  
Kirchhoff's law.  
Basic troubleshooting strategy  
Introduction to instrumentation | Chapter 4  
Section checkup questions  
Continue circuit diagrams study |
| 4    | 4,5                       | Electrical Fundamentals parallel circuits, Wheatstone bridge and balancing bridges  
Troubleshooting parallel circuitry  
Circuit diagrams  
Introduce Reed switches | Chapter 5 sections 1-5  
Section checkup questions  
Application of reed switches in the system. Troubleshooting reed switches in the mechatronic system |
| 5    | 4,5                       | Electrical Fundamentals Current dividers and parallel circuitry. Troubleshooting parallel circuits Introduce relays | Chapter 5 sections 6 -8  
Section checkup questions  
Application of relays and troubleshooting relays in the mechatronic system |
<table>
<thead>
<tr>
<th>Week</th>
<th>Sections</th>
<th>Topics</th>
</tr>
</thead>
</table>
| 6    | 4,5      | Electrical fundamentals  
Combination parallel and series circuits. Voltage dividers  
Introduce indicators | Chapter 6 sections 1 -4  
Section checkup questions  
Application of indicators and troubleshooting in the mechatronic system |
| 7    | 4,5,6    | Electrical fundamentals  
Wheatstone bridge and balancing bridges. Power applications  
Troubleshooting bridges  
Introduce solenoids  
Mid Term Exam | Chapter 6 section 5-9  
Section checkup questions  
Application of solenoids in the mechatronic system. Troubleshooting techniques for solenoids |
| 8    | 6        | Electrical fundamentals  
Electromagnetism, magnetic fields, induction  
Introduce switches and photoelectric sensors | Chapter 7 sec 1 thru 5  
Section checkup questions  
Application of switches and photoelectric sensors in mechatronic system  
Application of troubleshooting techniques for switches and sensors |
| 9    | 6,7      | Electrical fundamentals  
Dc motors and generators  
Introduce capacitive sensors  
QUIZ 3 | Chapter 7 sec 6 and 7  
Application of Capacitive sensors in the mechatronic system. Troubleshooting techniques for capacitive sensors |
| 10   | 6,7,8    | Electrical fundamentals  
Introduction to AC circuitry. Discussion on sine wave instrumentation for measurement. Discussion of the fundamentals of polyphase (3 phase) AC power. | Chapter 8 sec 1 -5  
Section check ups  
Application of instrumentation for AC measurement  
Instructor prepared presentation on polyphase power. |
### Course Syllabus: MECH 1100

**Instructional Schedule (continued):**

<table>
<thead>
<tr>
<th>Week</th>
<th>Dates</th>
<th>Topic</th>
<th>Chapters and Sections</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>6,7,8</td>
<td>Electrical fundamentals</td>
<td>Chapter 8 sec 6-9&lt;br&gt;Section check ups&lt;br&gt;Application of inductive sensors in the mechatronic system&lt;br&gt;Troubleshooting techniques for Inductive sensors</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>AC motors, non-sinusoidal waveforms&lt;br&gt;Introduce inductive sensors</td>
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<td></td>
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<tr>
<td>12</td>
<td>7,8,9,10</td>
<td>Electrical fundamentals</td>
<td>Chapter 9 sec 1-5&lt;br&gt;Chapter 16 sec 1-3&lt;br&gt;Chapter 17 sec 1&lt;br&gt;Section check ups&lt;br&gt;Troubleshoot problems in mechatronic system</td>
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<td></td>
<td></td>
<td>Capacitors, inductors, diodes, and transistors&lt;br&gt;Discuss system wiring diagrams</td>
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<td></td>
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<tr>
<td>13</td>
<td>8,9,10</td>
<td>Electrical fundamentals</td>
<td>Chapter 14&lt;br&gt;Section check ups&lt;br&gt;Application of power supplies in the mechatronic system&lt;br&gt;System troubleshooting electronics</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>DC power supplies and transformers&lt;br&gt;Review complete mechatronic system</td>
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<tr>
<td>14</td>
<td>3-10</td>
<td>Review complete mechatronic system</td>
<td>System troubleshooting specific problems as designed by instructor</td>
<td></td>
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<tr>
<td>15</td>
<td>3-10</td>
<td>Final Exam</td>
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